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ABSTRACT

Student achievement data from 92 school districts in South Carolina were analyzed to determine which input variables were most likely to affect educational quality. Fourth and seventh grade samples were scrutinized to determine the effects on achievement when the shared variation between achievement and the context variables was removed. The data consisted of four context, fourteen input, and five criterion indicators. Context indicators are those quantifiable variables which may affect educational quality but are not subject to change at the state or district level, e.g., racial composition of student population. Input indicators are those quantifiable characteristics which are subject to manipulation and which may significantly relate to learner outcomes, e.g., handicapping conditions. Criterion indicators are quantifiable variables which measure learner outcomes, e.g., dropout rate. The classification variable, school grade size, was also introduced. Major results were obtained through zero-order correlation analyses, partial correlation analyses, and regression analyses. Results showed that two context variables--racial composition of student population and percentage of students receiving free or reduced price lunches--were the best predictors of achievement at both the 4th and 7th grade levels. Local revenue per pupil and sparsity (density of school age population) were also consistently associated with achievement. This document presents a summary of the findings. (HV)

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Summary

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INDICATORS OF EDUCATIONAL QUALITY 1975-76

SUMMARY

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INDICATORS OF EDUCATIONAL QUALITY 1975-76

SUMMARY

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PREFACE

WHAT ARE THE BEST PREDICTORS OF STUDENT ACHIEVEMENT IN SOUTH CAROLINA SCHOOLS? IN WHICH SCHOOLS IS STUDENT ACHIEVEMENT CONSIDERABLY ABOVE OR BELOW THE PREDICTED ACHIEVEMENT?

In an effort to find answers to these questions, the Office of Research has conducted extensive analyses of data available within the Department of Education. This report summarized the methodology used and the results of those analyses. The reader who is pressed for time may wish to turn immediately to Page 10, "Results Section".

A detailed explanation of the study is contained in the Indicators of Educational Quality 1975-76, Technical Report, which, may be obtained by contacting the Educational Assessment Section, Office of Research, State Department of Education, Rutledge Building, Columbia, South Carolina.

District superintendents may request a copy of the District Outlier Summary, which is discussed in the "Results Section" of this report, from the Educational Assessment Section of the Office of Research.

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Introduction

In May of 1970, the South Carolina State Board of Education adopted "South Carolina's Educational Objectives for 1975", which consisted of Eleven Major Educational Objectives. One of these Major Objectives, the Evaluation Objective, was "to assess annually the educational quality of each school district in South Carolina".

Implicit in the wording of the Evaluation Objective was the assumption that indicators of educational quality could be identified and that once identified those indicators could be measured. Consequently, the general purpose of this objective was to implement an assessment program in order to identify and measure indicators of educational quality that yield information which has utility in educational decision making.

One specific purpose of the Evaluation Objective Assessment Program was that of determining the quality of the educational program offered in South Carolina through the State's system of free public education. Implied in this purpose was the necessity for collecting and analyzing data to yield information which could be used in the development of educational policy at the State level.

A second specific purpose of the Evaluation Objective Assessment Program was to determine the quality of the educational program which each local school district was providing in the public schools under the district's jurisdiction. Again, this purpose implied the collection and analysis of data in order to obtain information concerning educational quality. Information of this nature was not to be used

for the purpose of publicly ranking or comparing school districts. However, this information was to be used for decision-making purposes within the Department of Education. Additionally, the information could be utilized, in conjunction with data from other sources, as the basis for research on identifying promising educational programs or practices at the school or district levels.

Although not one of the specific purposes of the Evaluation Objective Assessment Program, local districts would have the option of using the data in any manner deemed appropriate by the district. The Department's intent was that district data would be relevant to decision making at the local level. In order to facilitate usage of the data at the district level, the Department of Education would provide assistance, to the extent possible, in the interpretation of data generated through the objective assessment program.

In order to fulfill the requirements of the Evaluation Objective, those factors which seemed to be indicative of educational quality had to be identified. Therefore, the Department Evaluation Planning Committee was assigned the task of identifying these indicators of educational quality. The initial identification of these indicators was necessarily limited to those indicators which were suggested in the assessment programs of other states and the philosophy, goals, objectives, and policies of the State Board of Education. The initial identification concentrated on existing departmental data related to educational outcomes. Based upon this information, personal knowledge, and experience, the Committee identified factors which were felt to be related to

educational quality. These factors were termed indicators of educational quality. For purposes of the Evaluation Objective Assessment Program, the indicators of educational quality were classified into three categories by the Committee. The three categories and their definitions follow:

1. Context indicators or constraints are those quantifiable characteristics or variables which may affect educational quality but which are not subject to manipulation or change at the State or local district level.

2. Input indicators are quantifiable characteristics or variables which are subject to manipulation or change at the State or local level and which by consensus of experts or empirical evidence bear a significant relationship to priority learner outcomes in the areas of knowledge, skills, attitudes, and behaviors.

3. Criterion indicators are quantifiable characteristics of variables which serve as measures of priority learner outcomes in the areas of knowledge, skills, attitudes, and behaviors.

Realizing that obtaining information on all desired student knowledge, skills, attitudes, and behaviors was not logically possible, the Evaluation Planning Committee restricted the categorical definitions to include only priority learner outcomes.

Once the context, input, and criterion indicators had been identified from existing data, a review of the literature was conducted to obtain information as to which context and input indicators were previously found to be most predictive of the criterion indicators. Other areas of interest in the literature review were the identification of additional factors which significantly contributed to educational quality and the statistical procedures utilized in the identification of these factors.

Statement of the Problem

The Indicators of Educational Quality Project was designed as a two-phase process. The first phase of the process consisted of providing each of the 92 districts in the State with a District Profile Report or status report at the district level. The District Profile Report was compiled to aggregate district information on all those indicators or variables which were identified by the Evaluation Committee as potentially related to student achievement. The second phase of the project and the focus of this summary involved the statistical analyses of the data compiled for the district profiles. The purpose of these statistical analyses was to determine which of the indicators were most critical in making a difference in educational quality. That is, school and district level data were analyzed in an attempt to identify which variables were related to student achievement. The assumption was that those indicators of quality identified through the analyses would be of aid to district personnel in the interpretation of their test data. Furthermore, the information on the relationships between student achievement and input variables (including policy and financial inputs) would hopefully be used in making decisions concerning district and State priorities and spending.

Thus, the following research questions, one at the 4th and one at the 7th grade levels, were the primary questions addressed in the second phase of the project:

1. What input variables are related to achievement in the 4th grade when the shared variation between achievement and the context variables is removed?
2. What input variables are related to achievement in the 7th grade when the shared variation between achievement and the context variables is removed?

Definitions of the Variables

The data which were utilized in this project consisted of four context indicators, fourteen input indicators, and five criterion indicators. Descriptions of these three categories of indicators are presented in this section of the report.

Since the major objective called for an annual assessment of the educational quality within each school district and since funding and testing time were limited, the selected indicators for assessing educational quality were obtained from existing data bases. A majority of the non-test data came from the Basic Educational Data System (BEDS), and most of the test data came from the Statewide Testing Program score reports.

Context Indicators

The context indicators or constraints are those quantifiable characteristics or variables which may affect educational quality but which are not subject to manipulation or change at the State or local district level.

The four context indicators included in this study were as follows: Racial Composition of Student Population, Percentage of Students Receiving Free or Reduced Price Lunches, Local Revenue per Pupil, and Sparsity Index.

Input Indicators

The input indicators are those quantifiable characteristics or variables which are subject to manipulation or change at the State or local level and which by consensus of experts or empirical evidence may bear a significant relationship to priority learner outcomes in the areas of knowledge, skills, attitudes, and behaviors.

The fourteen input indicators included: Attendance, Handicapping Conditions, Kindergarten Enrollment, Enrollment of Students by Average Class Size, Teacher's Education, Administrator's Education, Teacher Experience, Teacher Certification, Teacher Salary, Noninstructional Staff Salary, Teacher Turnover Rate, Expenditure per Pupil, Percent of District Personnel in the Central Office, and Tax Levy.

Criterion Indicators

The criterion indicators are quantifiable characteristics or variables which serve as measures of priority learner outcomes in the areas of knowledge, skills, attitudes, and behaviors.

The five criterion variables were: Achievement Test Scores on the content areas of Reading, Mathematics, Language, Total Battery, Science, Social Studies, and Reference Skills (Comprehensive Tests of Basic Skills scores from the Statewide Testing Program); Attitude Scores on the Individual

Adequacy and Social Adequacy Subscales (Psycho-Social Maturity Scale scores from the Statewide Testing Program); Dropout Rate; Employment Rate of Terminal Vocational Students; and Post-Secondary Enrollment.

Classification Variable

The classification variable School Grade Size was introduced into the study for analysis purposes because there were some public schools containing one class per grade level. In these schools, factors incidental to the class (e.g., the characteristics of the teacher) might have more meaning than the specific factors of interest in this study. Also, the character of such schools, many of which presumably contain several grades, might be quite different from schools with more typical class distributions in each grade. Based on this rationale, the School Grade Size variable was introduced.

The estimated size of the student body per grade was obtained by dividing the Average Daily Attendance by the number of grades in the school (kindergarten excluded). A school in the sample was classified as "small" if the school contained an average of 35 or fewer students per grade, as "medium" if the school contained an average of 36 to 70 students per grade, and as "large" if the school contained an average of more than 70 students per grade. Consequently, there were three school size groups for each of the 4th and 7th grade levels for a total of six groups. Many of the analyses which are described in Chapter III of the Technical Report were performed individually for each of the six school grade size groups. Given the available data, the school size

variable within small schools was viewed as a measure of class size since an alternative method of constructing such a measure was not available.

Predictor Variables

The term predictor variables was used to refer to both context and input variables since these two types of variables were examined in terms of predicting student performance on the criterion variables.

Additional Variable Information

The complete definitions of each indicator were included on each District's Profile Report.

When possible, the data were reported as percentages to enable comparisons between two or more schools on various indicators. Unfortunately, school-level data were not available for many of the variables of interest; and, therefore, district data were used in these cases.

Sample

The analyses of the project data required the establishment of criteria for the determination of those schools that were eligible for inclusion in the project data set. The primary eligibility criterion was the availability of Statewide Testing Program data at the school level. These test data were necessary for the measurement of the criterion variables. The second eligibility criterion concerned the organizational structure of the schools. Since one of the primary

objectives of this study was to identify what is often referred to as "school effects," the following assumption was made: for the school effects to be reflected in student performance, the student must have been enrolled in the school for at least one year. Since the Statewide Testing Program data were collected in the fall of the school year, only schools which housed both a 3rd and a 4th grade were included in the 4th grade analyses and only schools which housed both a 6th and a 7th grade were included in the 7th grade analyses.

The resultant sample at the 4th grade level consisted of 514 schools, and the resultant sample at the 7th grade level consisted of 188 schools. Of the 514 4th grade schools and 188 7th grade schools, 94 schools were considered both 4th and 7th grade eligible.

Procedures

The primary motivation directing the analyses of the relationship between the set of predictor variables (context and input variables) and the criterion variables was to identify input variables which were related to the criterion variables. The focus of the analyses was on the input variables since these variables are the only potentially manipulable variables.

The most direct manner in which this task could be accomplished was to develop a multiple regression equation to predict each criterion variable from the input variables. If the results were to have practical implications, however, a different strategy was suggested. Assuming that the context variables were not manipulable, the proper strategy was to eliminate variation in the criterion variables which was

related to the context variables and attempt to identify residual relationships among the criterion and input variables. Residual relationships are those relationships which account for unexplained variation. The reason for this identification process was that input variables, including matters of policy and financing, were the only predictor variables which could be viewed as modifiable.

Results

The major results from the project data were obtained by means of zero-order correlation analyses, partial correlation analyses, and regression analyses. Incorporated into these analyses were procedures to identify outlier schools, those schools whose differences between predicted achievement and actual or measured achievement were exceptionally high or low. These analyses are briefly described in this section.

First zero-order or simple correlations were computed for the 4th and 7th grade eligible schools to determine the relationships between the predictor variables and the criterion variable overall achievement (Total Battery, Comprehensive Tests of Basic Skills, Form S). The best predictors of achievement were the two non-manipulable context variables Racial Composition of Student Population and Percentage of Students Receiving Free or Reduced Price Lunches. At both the 4th and 7th grade levels, these two context variables correlated with achievement consistently in the .600 to .800 range. In other words, low achievement scores were related to high percentages of students receiving subsidized lunches and high percentages of nonwhite students. Local Revenue per Pupil and Sparsity Index were also consistently associated with achievement, but

the correlations were much smaller. Thus, two variables which are not subject to manipulation by educators were the best predictors of achievement; in other words, the context variables, Racial Composition of Student Population and Percentage of Students Receiving Free or Reduced Price Lunches, explain a large amount of the variation in the criterion variable overall achievement (Total Battery). Additionally, many input variables were correlated with achievement; and most of these correlations indicated relationships which agreed with intuition. However, these zero-order correlations were generally quite small.

The important question which needed to be considered before the relationships could be used as information for policy decisions involved the predictive power that the input variables provided beyond that associated with the context variables. This issue was investigated in the partial correlation analyses. Based on the partial correlation analyses, the strongest and most consistent of the input predictors at the 4th grade level was the variable School Attendance. At the 7th grade level, there were several significant input variables; however, none of these relationships were very consistent.

Finally, regression analyses were performed to determine the portion of the criterion variation that was uniquely explained by the context and input variables. In the 4th grade, roughly fifty percent of the criterion variation could be explained uniquely by the context variable set; in the 7th grade, approximately sixty percent of the criterion variation could be explained uniquely by the context variable set. On the other hand, the input variable set predicted only 5% and 1% of the criterion variation uniquely in the 4th and 7th grades, respectively.

The above figures were based on the analyses for all schools at each grade level. Therefore, in response to the two research questions, when the shared variation between the context variables and the criterion variables was removed, the input variables explained very little of the variation in the criterion variables.

After the identification of the context and input variables that were most predictive of achievement, outlier schools were identified. As mentioned previously, an outlier school is a school whose difference between predicted achievement and actual or measured achievement was exceptionally high or low. This difference gives a better idea of the performance of the students in the school than the actual mean achievement since variables beyond the control of the school are accounted for in calculating predicted mean achievement.

Stepwise regression procedures were first utilized to determine the equations for predicting achievement at the 4th and 7th grade levels. After the calculation of the simple difference between actual and predicted achievement, schools with exceptional values for this difference (outliers) were identified. The achievement differences were ordered from smallest to largest. Schools in the bottom 5% of this distribution, schools in which measured achievement was far below predicted achievement, were designated as "negative outliers". Similarly, schools in the top 5% of the distribution, schools in which measured achievement was far above predicted achievement, were designated as "positive outliers".

The results of the outlier analyses are not presented in this report. Instead, the results for each district will be made available to

that district. District Outlier Summaries will be sent to districts upon request.

Each District Outlier Summary includes predicted achievement, actual achievement, and the difference between these two values for each school in the district. Also included in the District Outlier Summary is the percentile rank of this difference with respect to all schools in the same grade level analysis and with respect to schools in the same grade and size stratum as the school. Schools identified as outliers are also designated in each District Outlier Summary. A mock-up of a District Outlier Summary is presented in Appendix A of the present report.

Discussion

The focus of this section will be the discussion of the study results at the 4th and 7th grade levels. However, a few comments regarding general difficulties with non-experimental studies and specific problems with this non-experimental study are presented.

The notion of causality is fundamental to the scientific enterprise. If based upon sound (almost always experimental) research, scientific cause and effect statements virtually guarantee that, if one variable X is modified, a concommitant change in another variable Y will occur. Although identifying relationships between X and Y, non-experimental studies cannot guarantee that changes in X will result in corresponding changes in Y. Non-experimental studies only indicate that there is a relationship between the variables as the units upon which the measurements were made occur naturally. Thus, there is no

guarantee that results of this study, if translated into policy recommendations, will result in changes in the performance of students, either in a short period or over a long period of time.

The major result of this study was that a large amount of achievement variation was associated with the few non-manipulable context variables and very little achievement variation was related to the rather extensive set of presumably manipulable input variables. How should these discouraging results be interpreted? Do these results mean that student kindergarten attendance, school personnel preparation and experience, school personnel salaries, etc., make very little difference? Intuitively, the answer to the latter question appears to be in a negative direction. However, a more in-depth investigation would be necessary in order to identify critical variables which would lead to potentially useful modifications in the educational enterprise.

Although teacher effects have been difficult to isolate, the contention is that analysis of the data at a classroom level would have a greater potential to uncover factors which are educationally important. Since classroom organization and teacher assignments are areas in which modifications could be easily effected, the identification of factors such as classroom racial balance, variation in ability, class size, and characteristics of the classroom teacher related to achievement would be extremely useful information for analysis purposes. Although surely not as powerful as variables describing the dynamics of the classroom teaching-learning situation, the utilization of readily available classroom level data would be an improvement in the study design.

Conclusions

Although probably viewed negatively, the most compelling conclusion which can be drawn from the various analyses of the project data is that, if useful results are to be generated from a future study, modifications in the design will be required. Although input variables such as student attendance, teacher degree status, teacher salary, school size, class size, and a few others were identified as being related to cognitive performance at certain grade levels, the relationships were minimal in comparison to those dealing with the more dominant context variables. The racial composition and social status of the students attending a school were the most powerful predictors of school mean achievement in the analyses. Very little residual association was identified which could be attributed to presumably manipulable input variables. The thesis of this research is that, if manipulable factors which relate to student achievement are to be identified, a more refined approach is required. This approach would take into account differential levels of data aggregation, the length of time the school has had to affect student performance, specifics of the classroom-learning environment, and the characteristics of the teacher fostering the classroom learning. Additionally, modifications in the operationalization and selection of variables is needed. Many suggestions as to how future studies might improve upon the present one are outlined in Chapter IV of the Technical Report.

APPENDIX A

Mock-up of District Outlier Summary

School District X

Following is a report of predicted and measured mean school achievement for schools in School District X in which 4th graders responded to the Comprehensive Tests of Basic Skills, Form S, Level 1, in the fall of 1975.

Elementary School #1

	Grade Equivalent	%ile
Measured (Actual) Achievement (Battery Total Subtest)	4.7	
Predicted Achievement among All 4th Grade Schools	3.9	
Percentile Rank of the Difference		97**
Predicted Achievement among Large 4th Grade Schools	3.9	
Percentile Rank of the Difference		98**

Elementary School #2

	Grade Equivalent	%ile
Measured (Actual) Achievement (Battery Total Subtest)	2.6	
Predicted Achievement among All 4th Grade Schools	3.5	
Percentile Rank of the Difference		0*
Predicted Achievement among Medium 4th Grade Schools	3.5	
Percentile Rank of the Difference		1*

Elementary School #3

	Grade Equivalent	%ile
Measured (Actual) Achievement (Battery Total Subtest)	4.4	
Predicted Achievement among All 4th Grade Schools	4.1	
Percentile Rank of the Difference		81
Predicted Achievement among 4th Grade Schools	4.1	
Percentile Rank of the Difference		76

* Indicates a "negative outlier" school.
** Indicates a "positive outlier" school.

Following is a report of predicted and measured mean school achievement for schools in School District X in which 7th graders responded to the Comprehensive Tests of Basic Skills, Form S, Level 2, in the fall of 1975.

Middle School #1

	Grade Equivalent	%ile
Measured (Actual) Achievement (Battery Total Subtest)	6.4	
Predicted Achievement among All 7th Grade Schools	6.6	
Percentile Rank of the Difference		38
Predicted Achievement among Large 7th Grade Schools	6.6	
Percentile Rank of the Difference		37

Middle School #2

	Grade Equivalent	%ile
Measured (Actual) Achievement (Battery Total Subtest	4.3	
Predicted Achievement among All 7th Grade Schools	5.7	
Percentile Rank of the Difference		1*
Predicted Achievement among Large 7th Grade Schools	6.0	
Percentile Rank of the Difference		0*

* Indicates a "negative outlier" school.
** Indicates a "positive outlier" school.

SCHOOL	WHITEPCT	LUNCHPCT	REVENUE	SPARCITY	ATTENPCT	T_SAL_2	T_SAL_TL	ADA	CENT_OF	BATT4N	SPECPCT	T_ED_I	AD456
El School #1	80	28.9	23	18	96	8550	9870	554	55	93	2.3	4	81
El School #2	68	36.9	23	18	94	8550	9870	199	19	18	2.3	0	81
El School #3	88	18.5	23	18	96	8550	9870	785	78	122	2.3	3	81
Mid School #1	59	31.6	23	18	93	8550	9870	671	67		2.3	0	81
Mid School #2	54	59.9	23	18	98	8550	9870	485	48		2.3	4	81